out involving the surrounding protoplasm (fig. 24 *c*-*f*). The result­ing nuclei at length cease to exhibit a nucleolus, and become directly transformed into the heads of spermatozoa; the tails are appropriated by each head from the common protoplasmic residue. The mother- cell in this case undergoes no increase in volume as development proceeds, and it is not enclosed within an “endothelial ” layer. In the second and apparently more usual case (*20*) no "cover- cell ” is formed, but the mother-cell divides and subdivides, protoplasm as well as nuclei, till a vast number of minute cells results ; the nucleus of each becomes the head of a spermatozoon and the protoplasm its tail. In this case the sperm-ball does increase in bulk : it grows as it develops, and the cavity containing it becomes lined by epithelium, or so-called “endothelium” (fig. 24 *j*). No doubt (*15*) the development of the epithelium stands in direct physiological connexion with the growth of the sperm-ball.

Obscure as are the details of this subject, suffi­cient is known to enable us to make out two chief types of development. One, common amongst the calcareous sponges, and possibly occurring in a single genus *(Gummina)* of the *Micromastictora*, is char­acterized by what is known as the “ amphiblastula ” stage ; the other, widely spread amongst the *Micromastictora (Reniera, Dcsmacidon, Euspongia, Spongelia, Aplysilla, Oscarella),* is characterized by a “ planula ” stage.

The first has been most thoroughly investigated in *Grantia raphanus* by Schulze (*20*). The ovum by repeated segmentation gives rise to a hollow vesicle, the wall of which is formed by a single layer of cells—*blastosphere* (fig. 25 *d*). Eight cells at one pole of the blastosphere now become differentiated from the rest ; they remain rounded in form, comparatively large, and become filled with granules (stored nutriment), while the others, rapidly multiplying by division, become small, clear, columnar, and flagellated. By further change the embryo becomes egg-shaped; the granular cells, now increased in number to thirty-two, form the broader end, and the numerous small flagellated cells the smaller end. Of the granular cells sixteen are arranged in an equatorial girdle adjoin­ing the flagellate cells. A blastosphere thus differen­tiated into two halves composed of different cells is known as an *amphiblastula.* The amphiblastula (fig. 25 *e)* now perforates the maternal tissue, and is borne along an excurrent canal to the oscule, where it is discharged to the exterior and swims about in a whirling lively dance.

It then assumes a more spherical form, a change premoni­tory of the next most remarkable phase of its career. In this the flagellated layer becomes flattened, depressed, and finally invaginated within the hemisphere of granular cells, to the inner face of which it applies itself, thus entirely obliterating the cleavage cavity, but by the same process originating another (the invagination cavity) at its expense (fig. 25 *f*). The two-layered sac thus produced is a *paragastrula* ; its outer layer, known as the *epiblast,* gives rise to the ectoderm, the inner layer or hypoblast to the endoderm. The paragastrula next becomes somewhat beehive- shaped, and the mouth of the paragastric cavity is diminished in size by an ingrowth of the granular cells around its margin. The larva now settles mouth downwards on some fixed object, and ex­changes a free for a fixed and stationary existence (fig. 25 *y*). The granular cells completely obliterate the original mouth, and grow along their outer edge over the surface of attachment in irregular pseudopodial processes, which secure the young sponge firmly to its seat (fig. 25 *h*). The granular cells now become almost trans­parent, owing to the exhaustion of the yolk granules, and allow the hypoblast within to be readily seen; a layer of jelly-like material, the rudimentary mesoderm, is also to be discerned between the two layers. The spicules then become visible ; slender oxeas appear first, and afterwards tri- and quadri-radiate spicules. The larva now elongates into a somewhat cylindrical form ; the distal end flattens ; and an oscule opens in its midst. Pores open in the walls ; the endodermal cells, which had temporarily lost their flagella, reacquire them, at the same time extending the character­istic collar. In this stage (fig. 25 *h, j)* the young sponge corresponds to a true Ascon, no trace of radial tubes being visible ; but as they characterize the parent sponge they must arise later, and thus we have clear evidence through ontogeny of the development of a Sycon sponge from an Ascon.

The three most striking features in the history of this larva are, first, the amphiblastula stage ; next the invagination of the flagel­late cells within the granular, instead of invagination in the reverse order ; and third the attachment of the larva by the oral instead of the aboral surface. Should Schulze be correct in deriving the sponges from the *Cœlentera,* it is probable that the reversal of the

Cœlenterate history as exemplified in the last two events will furnish an explanation of the remarkable divergencies which distinguish the two phyla. The history of the second or planula type has been thoroughly worked out by Schulze (*20*) in a little incrusting Tetrac- tinellid sponge (*Plakina monolopha,* Schulze). The ovum by regu­lar segmentation produces a blastosphere, the blastomeres of winch

increase in number by further subdivision till they become con­verted into hyaline cylindrical flagellated cells (fig. 26 *f*). Thus a blastosphere is produced consisting wholly of similar flagellated cells. It becomes egg-shaped, and, hitherto colourless, assumes a rose-red tint, which is deepest over the smaller end. The larva (now a planula, fig. 26 *a,* by the filling in of the central cavity) escapes from the parent and swims about broad end foremost. In this stage thin sections show that the cleavage cavity is obliterated, its place being occupied by a mass of granular gelatinous material contain­ing nuclei (fig. 26 *b*). In from one to three days after hatching the larva becomes attached. It then spreads out into a convex mass, and a cavity is produced within it by the splitting of the central jelly (fig. 26 *c*, *d* ; compare *Eucope* and others amongst the Cœlen­terates). This cavity becomes lined by short cylindrical cells (endo­derm), while the flagellated cells of the exterior lose their flagella and become converted into pinnacocytes (ectoderm). The gelatin­ous material left between the two layers now formed acquires the characters of true Collenchyme and thus becomes the mesoderm. The endoderm then sends off into the mesoderm, as buds, rounded chambers, which communicate with the paragastric cavity by a wide mouth and with the exterior by small pores (fig. 26 *e*). An oscule is formed later, and the sponge enters upon the Rhagon phase. Subsequent foldings of the sponge-wall give rise to a very simple canal system (fig. 26 *f*). In addition to these two well-ascertained modes of development others have been described which at present appear aberrant. In *Oscarella lobularis,* O.S. (*27),* a curious series of early developmental changes results in the formation of an irregular paragastrula, the walls of which become folded (while still within the parent sponge) in a complex fashion, so as to produce a form in which the incurrent and excurrent canals appear to be already sketched out before the flagellated chambers are differenti­ated off. In *Spongilla* Götte describes the ectoderm as becoming entirely lost on the attachment of the larva, so that the future sponge proceeds from the endoderm alone. As *Spongilla,* however,